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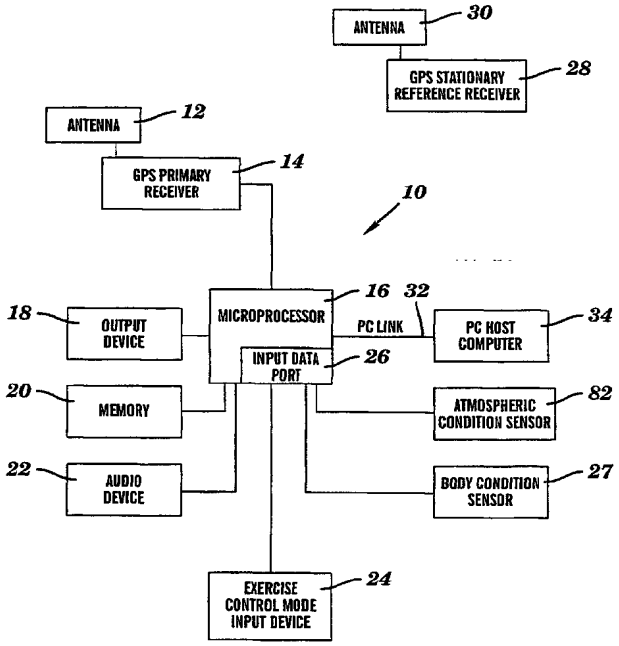
(54) Title: GPS BASED EXERCISE AND TRAINING MONITORING DEVICE



(57) Abstract: A device and method is disclosed which provides a Global Positioning (10) System (GPS) based exercise and training monitoring device. The device and method include a GPS in combination with at least one of a body condition sensor (27), a mode for exercise control (24), and an atmospheric condition sensor (82). The device may be worn on the body and calculate information such as heart rate, altitude, blood pressure, calories, etc.

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GPS BASED EXERCISE AND TRAINING MONITORING DEVICE

FIELD OF THE INVENTION

The present invention relates generally to exercising and training devices. More particularly, the present invention relates to a GPS based exercising and training monitoring device to calculate calorie information such as heart rate, altitude, blood pressure, and calories.

BACKGROUND OF THE INVENTION

Exercise devices are known in the art. The exercise devices may include a stationary bicycle, step climbing, tread mills, rowing machines, or other stationary apparatus. Commonly, a monitoring device may measure information such as heart rate, equivalent distance traveled, and the duration of the exercise. The equivalent distance is the distance that the device would move if it were not stationary. For example, the equivalent distance for a stationary bicycle would be calculated from the number of revolutions a pedal arm is turned times the virtual distance traveled per revolution. A readout device may indicate to the user how long they have exercised, and the equivalent distance that the user has traveled. The user remains in one location while using the exercise devices and

does not have the freedom of movement, such as climbing and descending hills. Thus, a need exists for an individual to obtain exercise information similar to the information obtained from a stationary exercise device while having freedom of movement.

SUMMARY OF THE INVENTION

The present invention provides a Global Positioning System (hereinafter "GPS") in combination with an exercise and training monitoring device that allows a user freedom of movement while exercising. The GPS based exercise and training monitoring device may be worn by the user and includes a GPS to determine distances traveled during exercise. Additionally, body condition sensors may measure, for example, heart rate, blood pressure, pulse rate, carbon dioxide levels, etc. Atmospheric condition sensors may measure, for example, air temperature, humidity, atmospheric pressure, etc. The GPS based exercise and training monitoring device calculates the total calories expended by the user.

The present invention in one embodiment generally provides an apparatus comprising:

a microprocessor;

a body condition sensor, operatively attached for providing data to the microprocessor;

a GPS receiver, operatively attached for providing data to said microprocessor; and

an output device for providing data from the microprocessor.

The present invention in another embodiment comprises:

a microprocessor;

a mode for exercise control, operatively attached for providing data to the microprocessor;

a GPS receiver, operatively attached for providing data to the microprocessor; and

an output device for providing data from the microprocessor.

The present invention in another embodiment comprises:

a microprocessor;

an atmospheric condition sensor, operatively attached for providing data to the microprocessor;

a GPS receiver, operatively attached for providing data to the microprocessor; and

an output device for providing data from the microprocessor.

The present invention provides a method comprising the steps of:

providing an exercise and training monitoring device operatively attached to a GPS system;

attaching the exercise and training monitoring device

to a user;

inputting locational movement data of the user from the GPS in the exercise and training monitoring device;

inputting body condition data to the exercise and training monitoring device; and

displaying information to the user on an output device.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention will best be understood from a detailed description of the invention and a preferred embodiment thereof selected for the purposes of illustration and shown in the accompanying drawings in which:

FIG. 1 illustrates a diagram of a GPS based exercise and training monitoring device in accordance with the present invention;

FIG. 2 illustrates a plan view of a display device of the GPS based exercise and training monitoring device;

FIG. 3 illustrates a plan view of the display device including a time and speed readout;

FIG. 4 illustrates a plan view of the display device including a speed and distance readout;

FIG. 5 illustrates a plan view of the GPS based exercise and training monitoring device connected to a Personal Computer;

FIG. 6 illustrates a diagram of a mode selection and a data entry and display flowchart;

FIG. 7 illustrates a perspective view of a user interacting with a kiosk apparatus; and

FIG. 8 illustrates a table of calories expended during various activities.

DETAILED DESCRIPTION OF THE INVENTION

Although certain preferred embodiments of the present invention will be shown and described in detail, it should be understood that various changes and modifications may be made without departing from the scope of the appended claims. The scope of the present invention will in no way be limited to the number of constituting components, the materials thereof, the shapes thereof, the relative arrangement thereof, etc., which are disclosed simply as an example of the preferred embodiment. The features and advantages of the present invention are illustrated in detail in the accompanying drawings, wherein like reference numerals refer to like elements throughout the drawings. Although the drawings are intended to illustrate the present invention, the drawings are not necessarily drawn to scale.

FIG. 1 illustrates a diagram of a GPS based exercise and training monitoring device 10 in accordance with the present

invention. The GPS based exercise and training monitoring device 10 includes an antenna 12, a GPS primary receiver 14, a microprocessor 16, an output device 18, a memory device 20, an audio device 22, an exercise control mode input device 24, an input data port 26, a body condition sensor 27, an atmospheric condition sensor 82, and a PC link 32. The GPS primary receiver 14 receives signals through the antenna 12 from a network of satellites (not shown). Each satellite acts as a reference point for the GPS primary receiver 14. The location for each satellite is well known. By measuring the travel time of signals transmitted from each satellite, the primary GPS receiver 14 on the ground can determine its distance from each satellite. To calculate its distance to the satellite, the GPS primary receiver 14 transfers the travel time information to the microprocessor 16. To determine the distance to a satellite, the microprocessor 16 multiplies the travel time by the speed of light. Using distance measurements from a plurality of satellites, the microprocessor 16 may calculate the location, course and speed of movement of the GPS primary receiver 14. The location may include the latitude, longitude, and altitude of the GPS primary receiver. The location may be determined within about 100 meters.

Currently, this low accuracy is the result of errors that result from various sources. For example, satellite errors, atmospheric delay, multipath errors, receiver errors, and

selective availability errors cause the low locational accuracy. Satellite errors may be the result of satellite positional inaccuracies. Also, errors in the satellite time keeping clock may lead to inaccuracies in the satellite position measurements. Location calculations are based on the assumption that the radio signals travel at the speed of light in a vacuum, however, delays may occur as the radio signal passes through the atmosphere. These atmospheric delays may be caused by charged particles in the ionosphere. Reflection of the GPS signal off local obstructions may cause direct and reflected signals to arrive at the antenna 12 at different times. These delayed signals may interfere with the direct signal and cause location calculation inaccuracies. The GPS primary receiver 14 errors may be caused by internal noise or clock inaccuracy. Selective Availability (SA) errors are intentional errors generated by an agency such as the U.S. Department of Defense. The idea behind Selective Availability errors is to ensure that no hostile force turns the locational accuracy against the U.S. or its allies. Under Selective Availability, intentional noise is introduced into the GPS satellite clock to reduce their accuracy. Additionally, the satellites may be given slightly erroneous orbital data which is transmitted to the GPS primary receiver 14 and results in further locational calculation error.

In order to overcome the locational inaccuracies, a differential GPS system is incorporated that cancels out most of

the inaccuracies mentioned above. The differential GPS system includes a GPS stationary reference receiver 28 that is placed at a fixed known location. The GPS stationary reference receiver 28 includes an antenna 30 for receiving signals from the GPS satellites and for sending signals to the GPS primary receiver 14. Since the GPS stationary reference receiver 28 knows where the GPS satellites are supposed to be in space, and it knows exactly where it is, it can compute a theoretical distance between itself and each satellite. It divides that distance by the speed of light and gets a time. This time is how long the signals should have taken to reach it. It compares the theoretical time with the actual time. Any difference is the error or delay in the satellite signal. Next, the stationary reference GPS receiver 28 gives this error information to the roving GPS primary receiver 14 so that roving GPS primary receiver 14 can correct its measurements. Using differential GPS, the accuracy of the location of the GPS primary receiver 14 can be within about 3 to 5 meters.

The GPS primary receiver 14 and the GPS stationary reference receiver 28 transmit time, location, and altitude information to the microprocessor 16. The microprocessor 16 uses the data from the GPS primary receiver 14 and the GPS stationary reference receiver 28 to calculate the location and altitude of the user. The microprocessor 16 may calculate a speed, a trajectory, an acceleration, a change in elevation, a

total distance traveled, and a calorie loss for the user.

The input data port 26 transfers data from the body condition sensor 27, the atmospheric condition sensor 82, and from the exercise control mode input device 24 to the microprocessor 16. The body condition sensor 27 may include any suitable measurement device, e.g., heart rate, blood pressure, pulse rate, carbon dioxide levels, etc. The atmospheric condition sensor 82 may include any suitable measurement device, e.g., air temperature, humidity, atomospheric pressure, etc.

A PC link 32 as illustrated in FIG. 1 connects the microprocessor 16 with a PC (personal computer) host computer 34. The PC link 32 may transfer data from the microprocessor 16 to the PC host computer 34 and may transfer data from the PC host computer 34 to the microprocessor 16.

FIG. 2 illustrates the exercise control mode input device 24 including buttons 36, 38, 40, and 42. The exercise control mode input device 24 is mounted on a housing 44. Data entered using the exercise control mode input device 24 is sent from the exercise control mode input device 24 through the input data port 26 to the microprocessor 16. The housing 44 encloses the antenna 12, the GPS primary receiver 14, the microprocessor 16, the memory device 20, the input data port 26, and the audio device 22. The PC link 28 is attached to a connector 48 located on the side 46 of the housing 44. The connector 48 is connected to the microprocessor 16.

The output device 18 is attached to the housing 44. The output device 18 may include any suitable display device, e.g., screen, liquid crystal display, etc. The output device 18 may provide readings to the user, for example, time, speed, distance, calories expended, and calories expended per minute. Additionally, the output device 18 may include an arrow that will display and continuously point towards a predetermined location. The predetermined location may be entered by the user. For example, the predetermined location may be the location of the user's home. Then the arrow will continuously point toward the user's home. The user may travel in the direction of the arrow to return home. The housing 44 may be attached to the user's body in locations such as a wrist, a belt, or on an arm. The microprocessor 16 receives location information from the GPS primary receiver 14 and the GPS stationary reference receiver 28 and calculates the user's location, speed and altitude. The locational information is typically, measured in about 1 second intervals of time. The locational, altitude, and time information is stored in the memory device 20. Additional information, for example, the user's age, weight, gender, height, heart rate, blood pressure, carbon dioxide levels, etc. may be stored in the memory device 20. The information stored in the memory device 20 may be used to calculate the calories expended during a set of exercises. The calculations may be performed using the microprocessor 16 or

using the PC host computer 34. When using the PC host computer 34, the information located in the memory device 20 is transferred through the microprocessor 16 and through the PC link 32 to the PC host computer 34.

FIG. 3 illustrates the output device 18 providing a time and speed reading to the user. The exercise control mode input device 24 may include the "mode" button 36 which allows the user to select a mode 50 (FIG. 6). The "enter" button 38 allows the user to enter a selected mode 50. The "up" button 40 allows the user to scroll in an upward direction through the mode 50. The "down" button 42 allows the user to scroll in a downward direction through the mode 50. FIG. 4 illustrates the output device 18 providing the user a reading of speed and distance traveled during exercise.

FIG. 5 illustrates the GPS based exercise and training monitoring device 10 including the PC link 32 connection between the microprocessor 16 and the PC host computer 34. The PC link 32 connects to the microprocessor 16 through the connector 48. The output device 18 indicates that the user may press the "enter" button 38 to start the transfer of data from the memory device 20 through the microprocessor 16 to the PC host computer 34.

FIG. 6 illustrates a diagram of a mode selection 50 and a data entry and display 62 flowchart. The mode selection 50 may include an activity 52, an exercise 54, a set physical

parameters 56, a PC link 58, and an other data 60 selection. Pressing the "mode" button 36 repeatedly scrolls through the activity 52, exercise 54, set physical parameters 56, PC link 58, and other data 60 selection. When the activity 52 mode is selected, the user may press the "up" button 40 or the "down" button 42 to scroll upward or downward through the activities, respectively. The activity 52 includes a running 52A, a bicycle 52B, a walking 52C, a swimming 52D, a skating 52E, a rowing 52F, and a none 52G selection.

FIG. 8 illustrates a table of calories expended during various physical activities. These values may be used by the microprocessor 16 to calculate calories expended during exercise activities.

The mode selection 50 for exercise 54 may include a start 54A, a stop 54B, and a reset 54C selection. When the exercise 54 mode is selected, the user may press the "up" button 40 or the "down" button 42 to scroll upward or downward through the exercise 54 selections, respectively. After selecting a start 54A function, the user may press the "enter" button 38 to start the data gathering process in the microprocessor 16. Additionally, the output device 18 is activated to display 64 information such as time. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 and to return to the mode selection 50. After selecting the stop 54B function, the user may press the "enter" button 38 to

stop the data gathering process in the microprocessor 16. Additionally, the output device 18 is activated to display information such as distance traveled. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 and to return to the mode selection 50.

After selecting the reset 54C function, the user may press the "enter" button 38 to reset the microprocessor 16 and to reset the output device 18 to display a zero value. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 and to return to the mode selection 50.

The mode selection 50 for set physical parameters 56 may include a weight 56A, a height 56B, an age 56C, a gender 56D, a units 56E, a sound 56F, and an audible feedback mode selection 56G. When the set physical parameters 56 mode is selected, the user presses the "up" button 40 or the "down" button 42 to scroll upward or downward through the set physical parameter 56 selections, respectively. When the weight 56A is selected, the user may press the "enter" button 38 to activate the output device 18 which indicates an "enter weight" display 66A. Next, the user may press the "up" button 40 or the "down" button 42 to select a value for the user's weight. Then the user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 and to return to the mode selection 50.

When the height 56B is selected, the user presses the

"enter" button 38 to activate the output device 18 which indicates an "enter height" display 66B. Next, the user may press the "up" button 40 or the "down" button 42 to select a value for the user's height. Then the user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the age 56C is selected, the user presses the "enter" button 38 to activate the output device 18 which indicates an "enter age" display 66C. Next, the user may press the "up" button 40 or the "down" button 42 to select a value for the user's age. Then the user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the gender 56D is selected, the user may press the "enter" button 38 to activate the output device 18 which indicates a "choose gender" display 66D. Next, the user may press the "up" button 40 or the "down" button 42 to select the gender (male, or female) of the user. Then the user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the units 56E is selected, the user may press the "enter" button 38 to activate the output device 18 which indicates a "chooses miles or meters" display 66E. Next, the user may press the "up" button 40 or the "down" button 42 to select miles or meters for displaying distances. Then the user

may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the sound 56E is selected, the user may press the "enter" button 38 to activate the output device 18 which indicates a "turn on or off" display 66F. Next, the user may press the "up" button 40 or the "down" button 42 to turn on or to turn off the audio device 22. Then the user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the audible feedback mode 56G is selected, the user may press the "enter" button 38 to activate the output device 18 which indicates a "choose sound mode" display 66G. Next, the user may press the "up" button 40 or the "down" button 42 to choose from any suitable sound mode, e.g., pacing, mileage, etc. For example, during pacing, the audio device 22 may generate a tone for a selected number of paces. For mileage, the audio device 22 may generate a tone for each increment of distance traveled (e.g., mile, kilometer, etc.). Additionally, the GPS based exercise and training monitoring device 10 may include a timer mode. The timer mode may include a count down timer that may display on the display device 18 the time remaining in an exercise mode. Also, the audio device 22 may generate a tone when the count down timer reading reaches zero. The steps of an exercise program may be displayed on the display device 18.

This allows the user to monitor progress during the exercise program. The audio device 22 may also generate a tone at the completion of each step of the exercise program. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the PC link 58 mode is selected, the user may press the "up" button 40 or the "down" button 42 to scroll upward or downward to select the download human data 58A or the upload exercise data 58B data. When the download human data 58A is selected, the user presses the "enter" button 38 to activate the output device 18 and to start the transfer of data from the PC host computer 34 to the microprocessor 16 through the PC link 32. The output device 18 displays the transfer status 68, e.g., starting transfer, transfer in progress, transfer complete, etc. The data from the PC host computer 34 may include parameters, e.g., weight, height, age, gender, etc. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the upload exercise data 58B is selected, the user presses the "enter" button 38 to activate the output device 18 and to start the transfer of data from the microprocessor 16 through the PC link 32. The output device 18 indicates the transfer status 68, e.g., starting transfer, transfer in progress, transfer complete, etc. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry

and display 62 to return to the mode selection 50.

When the other data 60 mode is selected, the user may press the "up" button 40 or the "down" button 42 to select a display and use temperature 60A or a display and use humidity 60B mode. When the display and use temperature 60A is selected, the user may press the "enter" button 38 to activate the output device 18. The output device 18 may then display an ambient temperature 70A of the air surrounding the user. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

When the display and use humidity 60B is selected, the user may press the "enter" button 38 to activate the output device 18. The output device 18 may then display a humidity level 70B of the air surrounding the user. The user may press the "enter" button 38 or the "mode" button 36 to exit the data entry and display 62 to return to the mode selection 50.

FIG. 7 illustrates a perspective view of a user interacting with a kiosk apparatus 72. The kiosk apparatus 72 includes the PC host computer 34. The PC host computer 34 includes a display screen 74. When the user finishes an exercise set, the microprocessor 16 located within the housing 44 of the GPS based exercise and training monitoring device 10 is connected by the PC link 32 to the PC host computer 34. The informational data contained in the memory device 20 is uploaded through the microprocessor 16, through the PC link 32, and to the PC host

computer 34. The PC host computer 34 performs calculations using the informational data. The display screen 74 allows the user to observe exercise information. The information may be presented in the form of tables or graphs on the display screen 74. The graphs may be two or three dimensional. For example, the path of an exercise route may be graphed including altitude changes. Gradients along the displayed path may be shown, indicating rate of calorie loss. Additionally, speed and altitude may be displayed. The display screen 74 may also be a touch sensitive screen allowing the user to interact with PC host computer 34 by touching selected areas of the display screen 74. The user may enter other exercise data into the PC host computer 34 into a user's database. The user may interact with the PC host computer 34 to develop another exercise program. The user's database may be updated after each exercise set and training information may be printed out on a hard copy device 76 located in the kiosk apparatus 72. The user's health and exercise progress may be monitored for a first set of exercises performed. Based on the calories expended during the first set of exercises, a second set of exercises may be recommended to the user. The second set of exercises may be downloaded from the PC host computer 34 through the PC link 32 to the GPS based exercise and training monitoring device 10.

The PC link 32 may also transfer programming instructions from the PC host computer 34 to the GPS based exercise and

training monitoring device 10. These programming instructions allows a software program controlling the microprocessor 16 to be upgraded or modified.

The PC link 32 may also include any suitable wireless link (e.g., radio, infrared, etc.) between the microprocessor 16 and the PC host computer 34. Additionally, the PC link 32 may include a data transfer link through the internet. Also, the data from the PC host computer 34 may be transmitted through an internet connection 78 to a server 80 on the internet. The server 80 may be connected to a plurality of kiosks allowing the server 80 to monitor user exercise information from a plurality of locations and for a plurality of users.

The foregoing description of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and many modifications and variations are possible in light of the above teaching. For example, the GPS based exercise and training monitoring device 10 may be included in a Personal Digital Assistant type of computer. Such modifications and variations that may be apparent to a person skilled in the art are intended to be included within the scope of this invention as defined by the accompanying claims.

I/WE CLAIM:

1. An apparatus comprising:

a microprocessor;

a body condition sensor, operatively attached for providing data to the microprocessor;

a GPS receiver, operatively attached for providing data to said microprocessor; and

an output device for providing data from the microprocessor.

2. The apparatus of claim 1, further including a memory device connected to the microprocessor for storing data.

3. The apparatus of claim 1, further including a stationary reference GPS receiver for sending location correction information to the GPS receiver.

4. The apparatus of claim 1, further including an audible device for signaling a user.

5. The apparatus of claim 1, wherein the body condition sensor includes a heart rate sensor for measuring a heart rate of a user and a blood pressure sensor for measuring a blood pressure of the user.

6. The apparatus of claim 1, wherein the body condition sensor includes a carbon dioxide sensor for measuring a carbon dioxide level of a user.

7. The apparatus of claim 1, wherein the body condition sensor includes a pulse rate sensor for measuring a pulse rate of a user.

8. The apparatus of claim 1, wherein the microprocessor calculates a speed, a trajectory, an acceleration, a change of elevation, a total distance traveled, and a calorie loss for a user.

9. The apparatus of claim 1, wherein a PC link connects the microprocessor with a host computer.

10. An apparatus comprising:

a microprocessor;

a mode for exercise control, operatively attached for providing data to the microprocessor;

a GPS receiver, operatively attached for providing data to the microprocessor; and

an output device for providing data from the microprocessor.

11. The apparatus of claim 10, further including a memory device connected to the microprocessor for storing data.

12. The apparatus of claim 10, further including a stationary reference GPS receiver for sending location correction information to the GPS receiver.

13. The apparatus of claim 10, further including an audible device for signaling a user.

14. The apparatus of claim 10, wherein the mode for exercise control includes a mode of user activity.

15. The apparatus of claim 14, wherein the mode of user activity is selected from the group consisting of: running, bicycling, walking, swimming, skating, and rowing.

16. The apparatus of claim 10, wherein the mode for exercise control is selected from the group consisting of: weight, height, age, and gender information about a user.

17. The apparatus of claim 10, wherein the mode for exercise control includes a starting, stopping, and resetting selection.

18. The apparatus of claim 10, wherein the mode for exercise control includes a mode for setting physical parameters.

19. The apparatus of claim 18, wherein the mode for setting physical parameters is selected from the group consisting of: a weight, a height, an age, a gender, a distance unit, a sound, and an audible feedback mode.

20. The apparatus of claim 19, wherein the sound from the audible device is selectively turned on or off.

21. The apparatus of claim 18, wherein the audio feedback mode selects, a pacing, or a mileage mode.

22. The apparatus of claim 19, wherein the distance unit is miles or kilometers.

23. The apparatus of claim 18, wherein the exercise control mode input device is selected from the group consisting of: a mode button, an enter button, an upward scroll button, and a downward scroll button.

24. The apparatus of claim 10, wherein the mode of exercise control includes selecting a temperature and a humidity reading.

25. The apparatus of claim 10, wherein a PC link connects the microprocessor with a host computer.

26. The apparatus of claim 25, wherein the PC link includes downloading human data from the host computer to the microprocessor and uploading exercise data from the microprocessor to the host computer.

27. The apparatus of claim 26, wherein the downloading human data from the host computer to the microprocessor includes at least one of a weight, a height, an age, and a gender.

28. The apparatus of claim 26, wherein the uploading of exercise data from the microprocessor to the host computer includes a first set of exercises performed and the host computer further includes outputting a second set of exercises to be performed by a user.

29. The apparatus of claim 25, wherein the PC link includes a radio frequency connection.

30. The apparatus of claim 25, wherein the PC link includes an infrared connection.

31. The apparatus of claim 25, wherein the PC link includes an internet connection.

32. The apparatus of claim 24, wherein the host computer is located in a kiosk.

33. The apparatus of claim 25, wherein the host computer is a personal computer.

34. The apparatus of claim 10, wherein the data from the GPS receiver includes at least one of a time, a location, and an altitude information.

35. The apparatus of claim 34, wherein the time, the location and the altitude information is selectively displayed on the output device.

36. The apparatus of claim 10, wherein the microprocessor calculates at least one of a speed, a trajectory, an

acceleration, a change of elevation, a total distance traveled, and a calorie loss for a user.

37. An apparatus comprising:

a microprocessor;

an atmospheric condition sensor, operatively attached for providing data to the microprocessor;

a GPS receiver, operatively attached for providing data to the microprocessor; and

an output device for providing data from the microprocessor.

38. The apparatus of claim 37, further including a memory device connected to the microprocessor for storing data.

39. The apparatus of claim 37, further including a stationary reference GPS receiver for sending location correction information to the GPS receiver.

40. The apparatus of claim 37, further including an audible device for signaling a user.

41. The apparatus of claim 37, wherein the microprocessor calculates at least one of a speed, a trajectory, an acceleration, a change of elevation, a total distance traveled, and a calorie loss for a user.

42. The apparatus of claim 37, wherein the atmospheric condition sensor includes a temperature sensor.

43. The apparatus of claim 37, wherein the atmospheric condition sensor includes a humidity sensor.

44. The apparatus of claim 37, wherein the atmospheric condition sensor includes an atmospheric pressure sensor.

45. A method comprising the steps of:

providing an exercise and training monitoring device operatively attached to a GPS system;

attaching the exercise and training monitoring device to a user;

inputting locational movement data of the user from the GPS in the exercise and training monitoring device;

inputting body condition data to the exercise and training monitoring device; and

displaying information to the user on an output device.

46. The method of claim 45, wherein the body condition data is selected from the group consisting of: a heart rate, a blood pressure, a pulse rate, and a carbon dioxide level.

47. The method of claim 45, further including the step of providing a mode for exercise control in the exercising and training monitoring device.

48. The method of claim 47, wherein the mode for exercise control is selected from the group consisting of: running, bicycling, walking, swimming, skating, and rowing.

49. The method of claim 47, wherein the mode for exercise

control, is selected from the group consisting of: weight, height, age, and gender information about the user.

50. The method of claim 45, further including the step of providing an atmospheric condition sensor operatively attached to the exercise and training monitoring device.

51. The method of claim 50, wherein the atmospheric condition sensor is selected from the group consisting of: a temperature, a humidity, and an atmospheric pressure sensor.

52. The method of claim 45, further including the step of calculating at least one of a speed, a trajectory, an acceleration, a change of elevation, a total distance traveled, and a calorie loss for the user.

53. The method of claim 45, further including the step of providing a PC link connecting the exercise and training monitoring device to a host computer.

54. The method of claim 53, wherein the PC link includes downloading human data from the host computer to the microprocessor and uploading exercise data from the microprocessor to the host computer.

55. The method of claim 45, wherein the exercise and training monitoring device further includes an audible device for signaling the user.

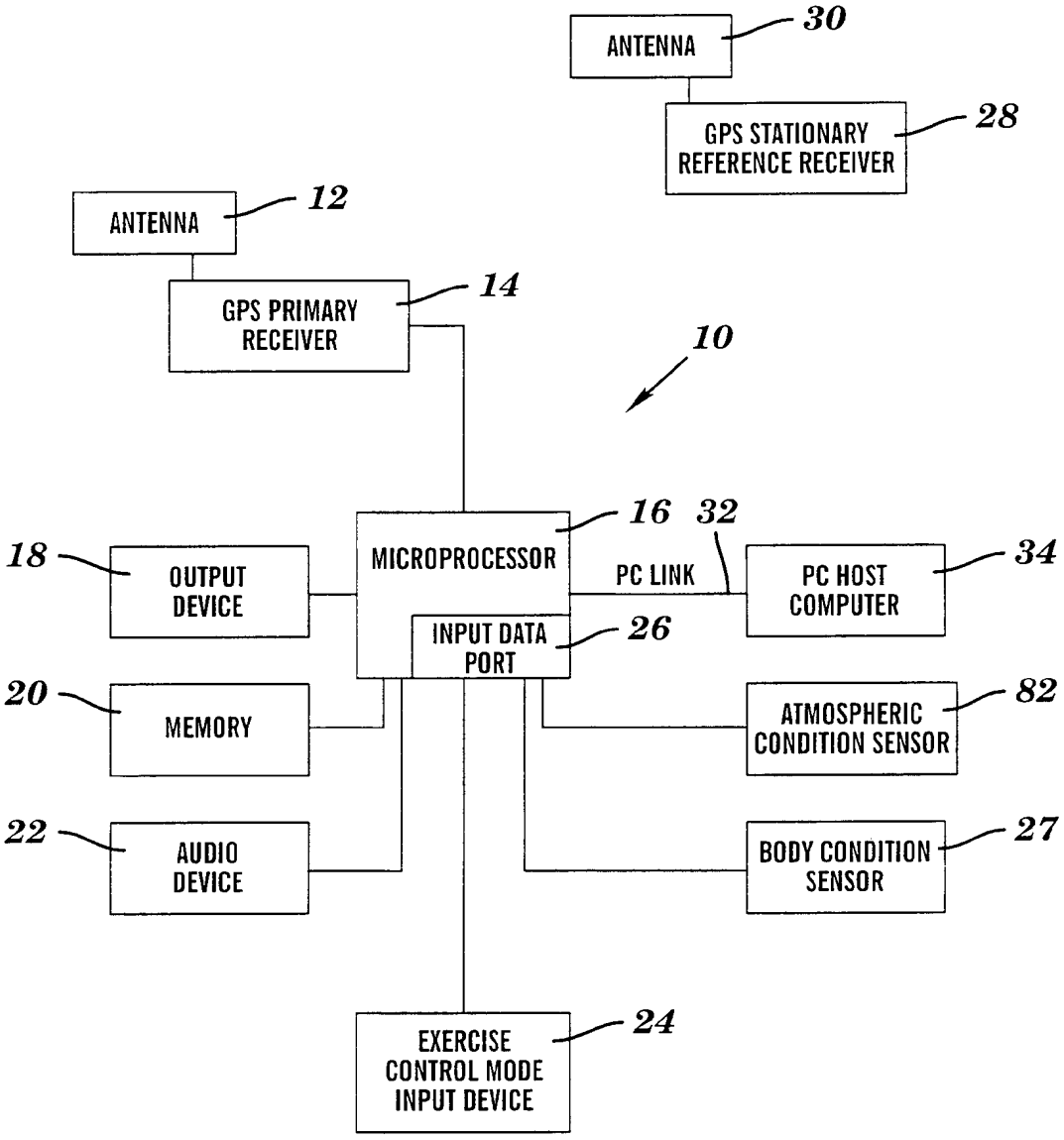
ANTENNA
30
GPS STATIONARY REFERENCE RECEIVER
28
ANTENNA
12
GPS PRIMARY RECEIVER
14
10
16
32
MICROPROCESSOR
PC LINK
PC HOST COMPUTER
34
18
OUTPUT DEVICE
INPUT DATA PORT
26
20
MEMORY
ATMOSPHERIC CONDITION SENSOR
82
22
AUDIO DEVICE
BODY CONDITION SENSOR
27
EXERCISE CONTROL MODE INPUT DEVICE
24

FIG. 1

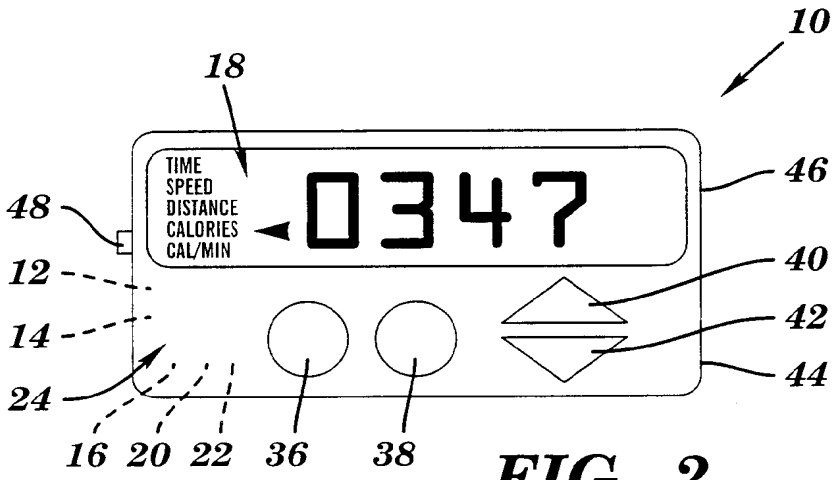

FIG. 2

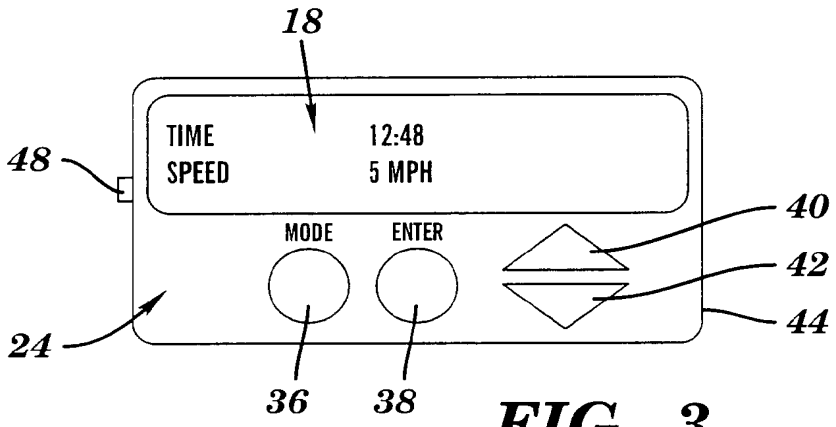

FIG. 3

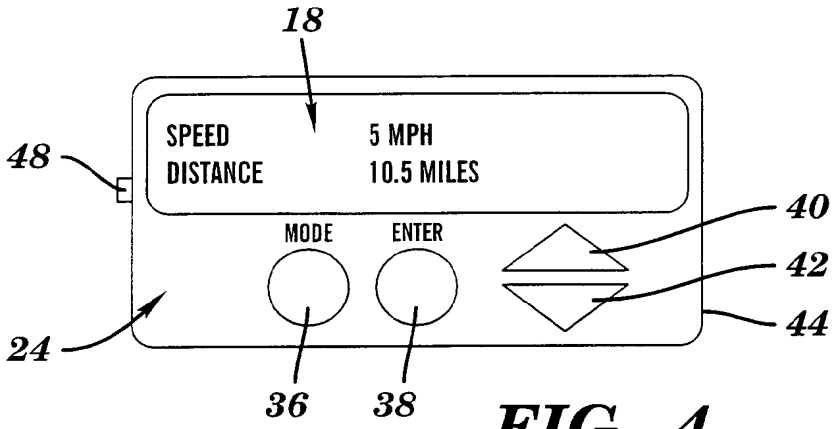

FIG. 4

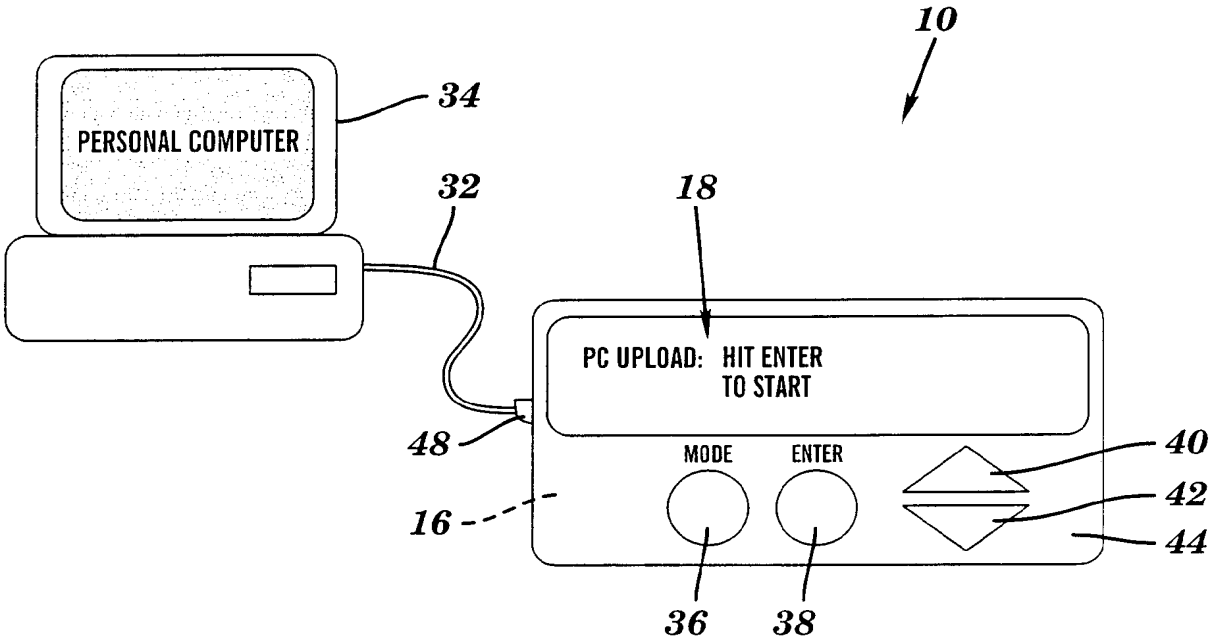
10
34
PERSONAL COMPUTER
32
18
PC UPLOAD: HIT ENTER
TO START
48
MODE
ENTER
40
42
44
16
36
38

FIG. 5

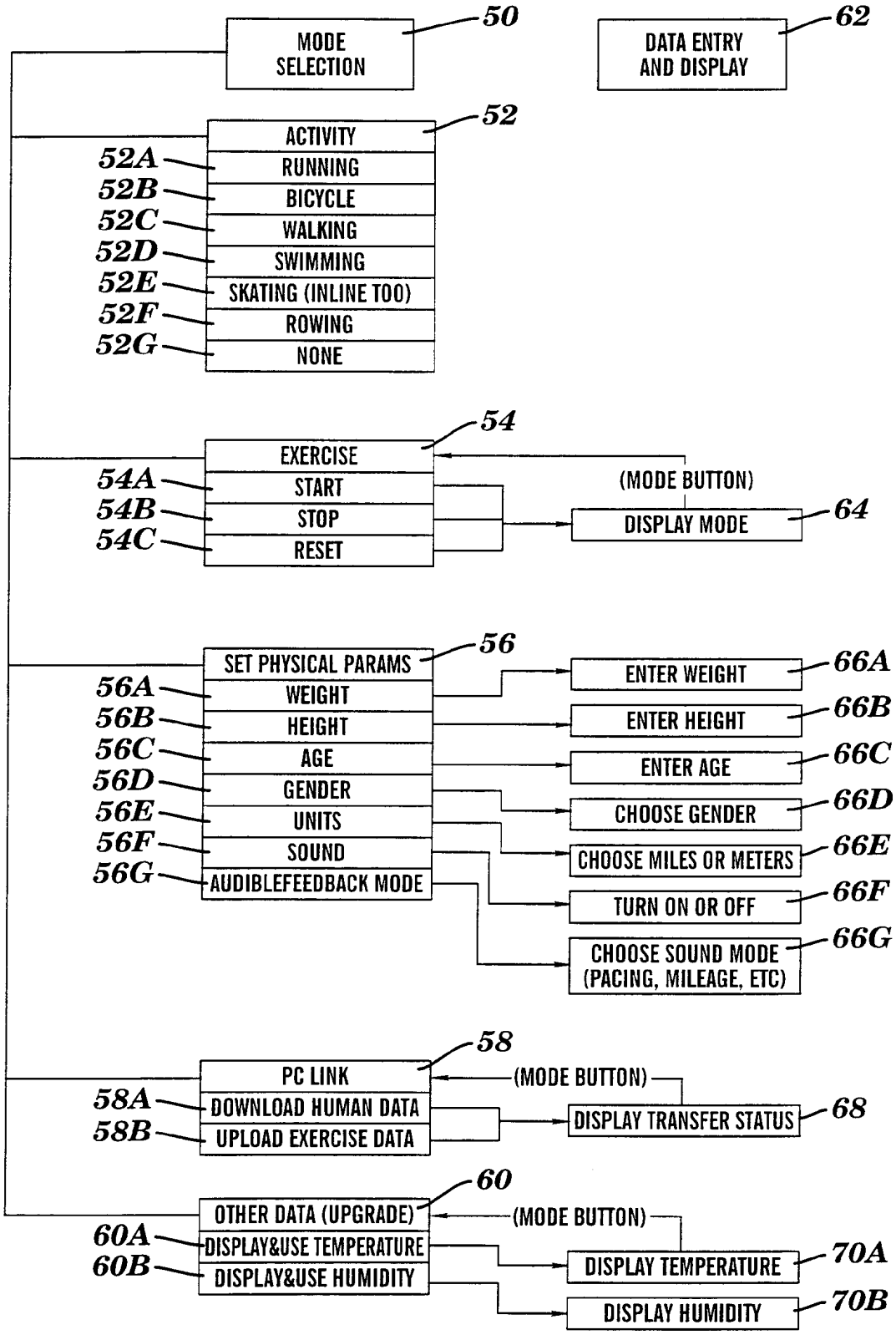
MODE SELECTION
50
DATA ENTRY AND DISPLAY
62
ACTIVITY
52
52A RUNNING
52B BICYCLE
52C WALKING
52D SWIMMING
52E SKATING (INLINE TOO)
52F ROWING
52G NONE
EXERCISE
54
54A START
54B STOP
54C RESET
(MODE BUTTON)
DISPLAY MODE
64
SET PHYSICAL PARAMS
56
56A WEIGHT
56B HEIGHT
56C AGE
56D GENDER
56E UNITS
56F SOUND
56G AUDIBLEFEEDBACK MODE
ENTER WEIGHT
66A
ENTER HEIGHT
66B
ENTER AGE
66C
CHOOSE GENDER
66D
CHOOSE MILES OR METERS
66E
TURN ON OR OFF
66F
CHOOSE SOUND MODE (PACING, MILEAGE, ETC)
66G
PC LINK
58
58A DOWNLOAD HUMAN DATA
58B UPLOAD EXERCISE DATA
(MODE BUTTON)
DISPLAY TRANSFER STATUS
68
OTHER DATA (UPGRADE)
60
60A DISPLAY&USE TEMPERATURE
60B DISPLAY&USE HUMIDITY
(MODE BUTTON)
DISPLAY TEMPERATURE
70A
DISPLAY HUMIDITY
70B

FIG. 6

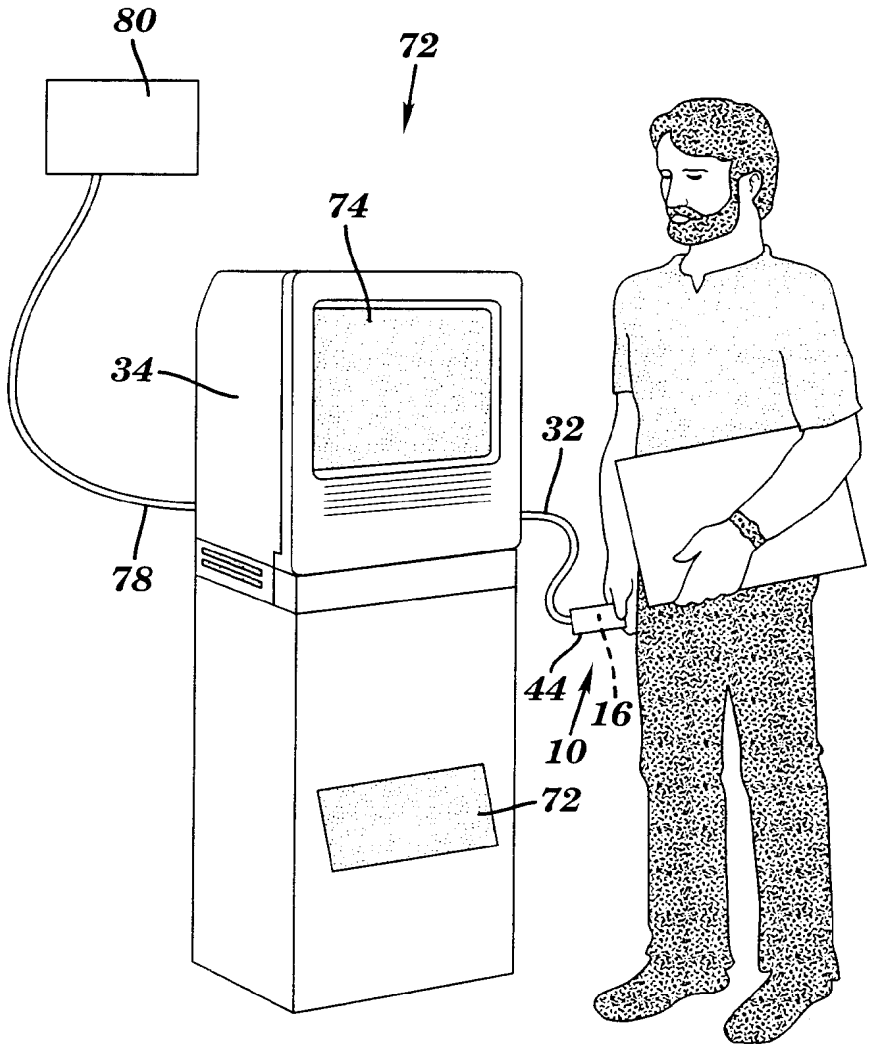

FIG. 7

TABLE OF ACTIVITIES AND CALORIES EXPENDED

ACTIVITY	CALORIES EXPENDED (CALORIES PER HOUR)
BICYCLING 6 MPH	240
BICYCLING 12 MPH	410
CROSS-COUNTRY SKIING	700
JOGGING 5 MPH	740
JOGGING 7 MPH	920
JUMPING ROPE	750
RUNNING IN PLACE	650
RUNNING 10 MPH	1280
SWIMMING 25 YDS./MIN	275
SWIMMING 50 YDS./MIN	500
TENNIS-SINGLES	400
WALKING 2 MPH	240
WALKING 3 MPH	320
WALKING 4 AND A HALF MPH	440

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/33109

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A63B 21/00
US CL :482/8

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 482/1-9, 900-902

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A, P	US 6,152,856 A (STUDOR et al) 28 Nov 2000, entire document.	1-55
A,P	US 6,002,982 A (FRY) 14 Dec 1999, entire document.	1-55
A,P	US 6,013,007 A (ROOT et al) 11 Jan 2000, entire document.	1-55

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 06 FEBRUARY 2001	Date of mailing of the international search report 22 MAR 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer GLENN RICHMAN Telephone No. (703) 308-0858

Form PCT/ISA/210 (second sheet) (July 1998) ★